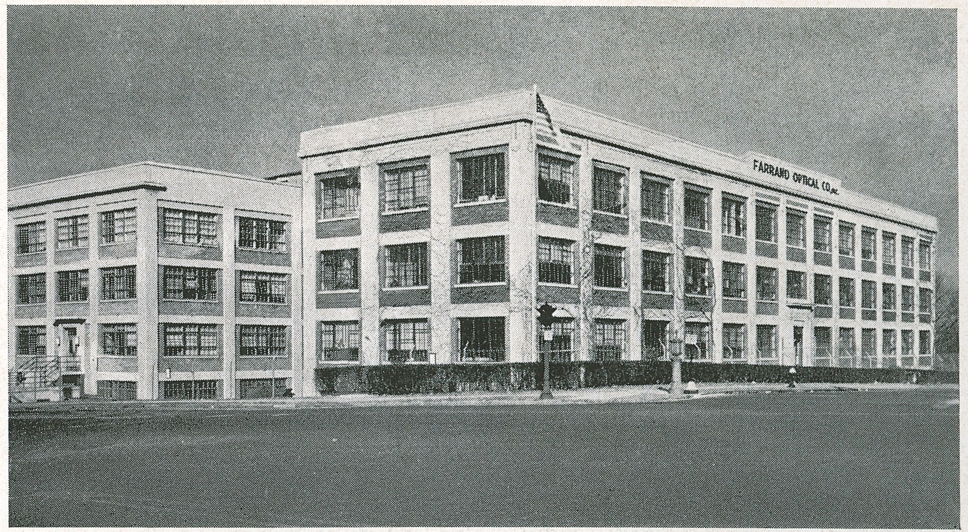
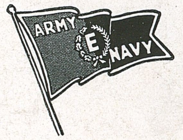
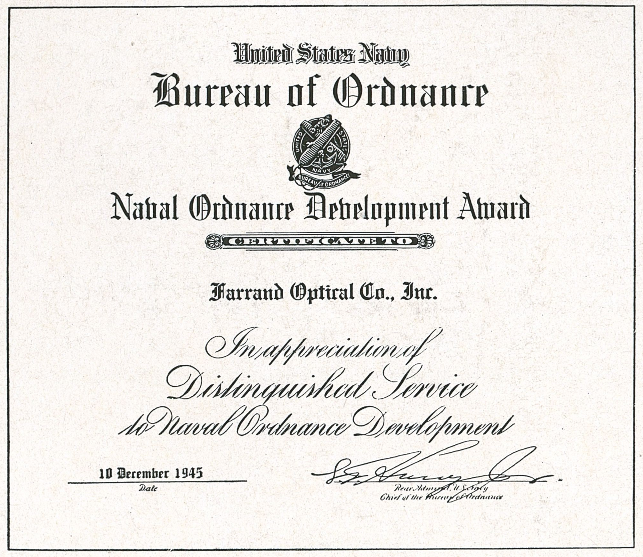


The facilities of the Farrand Optical Co., Inc. are available for design, engineering, development and production of scientific instruments.

We invite you to submit your requirements for special instruments as well as problems or ideas in connection with new developments.




United States Navy
Bureau of Ordnance

Naval Ordnance Development Award

Certificate to

Farrand Optical Co., Inc.

In appreciation of
Distinguished Service
to Naval Ordnance Development

10 December 1945
Date

Rear Admiral, U.S. Navy
Chief of the Bureau of Ordnance

FARRAND OPTICAL CO., INC.
Engineers, Designers and Manufacturers
PRECISION OPTICS, ELECTRONIC AND SCIENTIFIC INSTRUMENTS
BRONX BLVD. & E. 238TH ST. NEW YORK 66, N. Y.

BULLETIN - 801 - MAR. 1947

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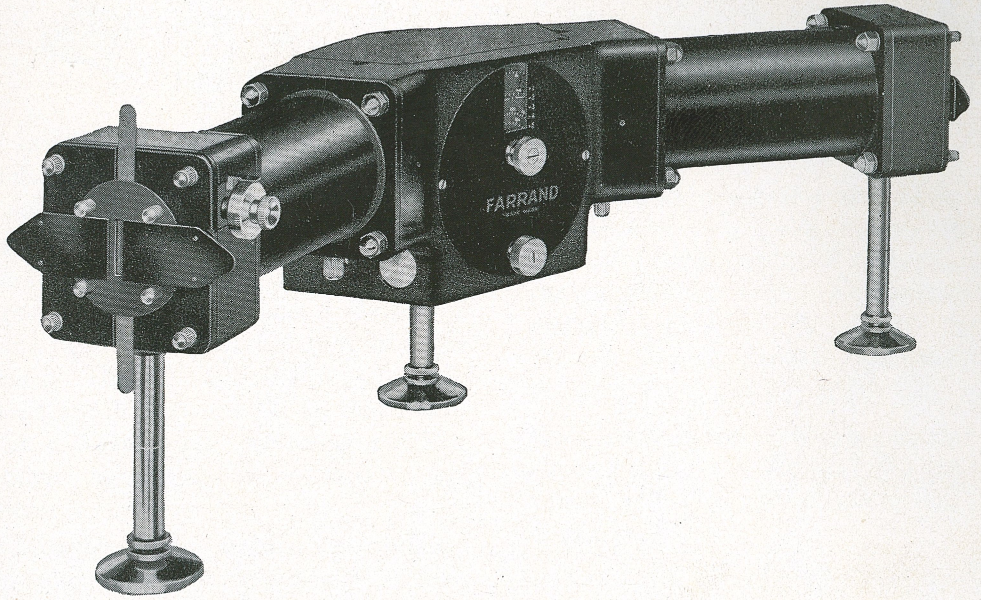
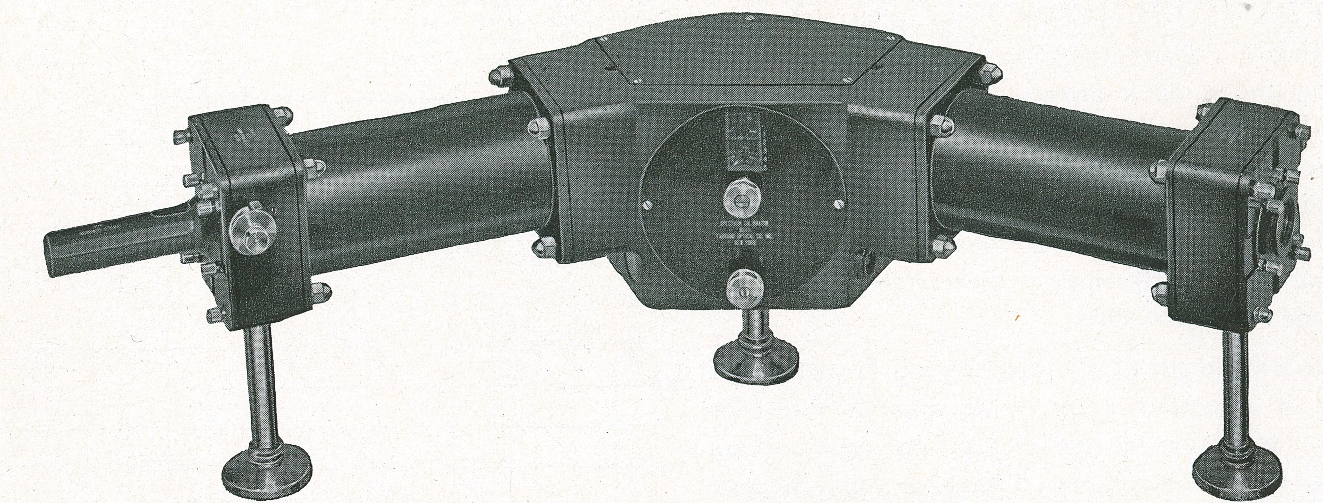
ULTRA-VIOLET MONOCHROMATOR



FARRAND OPTICAL CO., INC.
Engineers, Designers and Manufacturers
PRECISION OPTICS, ELECTRONIC AND SCIENTIFIC INSTRUMENTS

FARRAND ULTRA-VIOLET MONOCHROMATOR
RANGE 200 TO 800 MILLIMICRONS
QUARTZ-LITHIUM FLUORIDE OPTICS
75 MM FREE APERATURE f.4



DESIGN — OPERATION — PERFORMANCE

The Farrand ultra-violet Monochromator is an instrument developed to broaden the possibilities of research in the ultra-violet spectral region.

The design of the optics and mechanical components represent technological advances in instrumentation which have been utilized to produce a source of ultra-violet monochromatic light radiation of high intensity and purity. The Monochromator is rugged, flexible, and units are interchangeable so that it can also be used as a wavelength spectrometer and a spectrograph when augmented with suitable accessory equipment.

The Farrand Monochromator meets performance specifications ranging from routine analyses to most involved research.

OPTICAL SYSTEM

To insure the spectral purity, high resolution, wavelength selectivity, speed, color correction, and other physical characteristics of the optical system used in the Farrand ultra-violet Monochromator, the optical elements are carefully chosen from quartz and lithium fluoride crystals that meet exacting specifications for optical quality and chemical purity.

Only such elements which pass the tests for these characteristics are accepted for processing into the prism and lens components used for the Monochromator.

A schematic diagram of the optical system is illustrated in Figure 1.

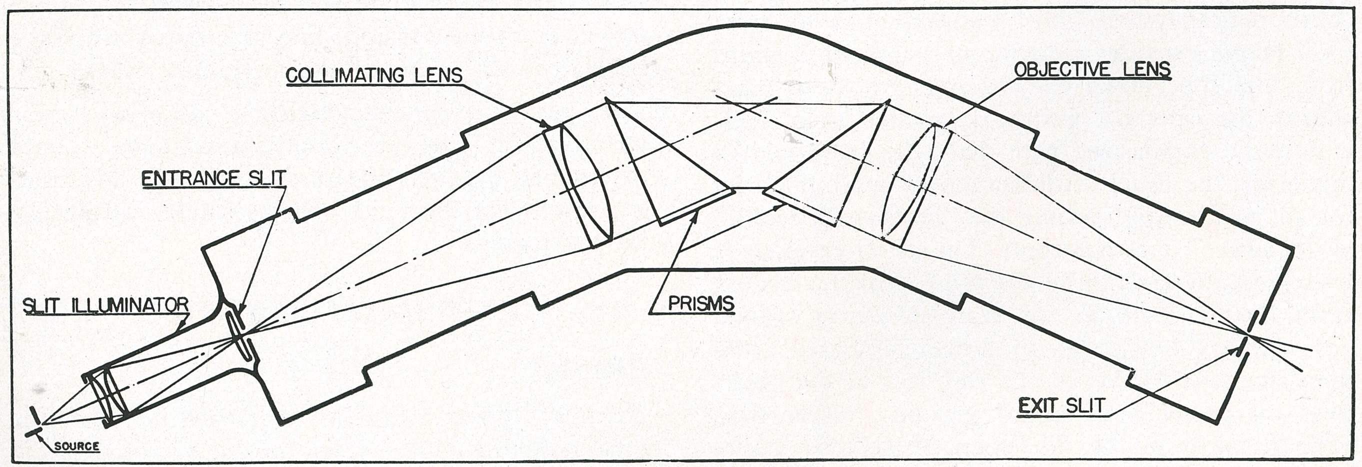


Fig. 1

Light from a source illuminates the entrance slit to cover completely the 75 mm. free aperture of the lenses and for the full height of the slit (30 mm.). When a broad light source is used, it is placed directly in front of the slit. Where narrow illuminating sources are employed, it is advisable to utilize the SLIT ILLUMINATOR. This is an accessory consisting of a quartz lens condensing system. The light from the source is passed through the entrance slit and is then collimated by the first quartz-lithium fluoride achromat objective. The resultant parallel radiation passes through the prism system where it is dispersed. The second quartz-lithium fluoride achromat objective images the entrance slit in the plane of the exit slit.

The wavelength of the light issuing from the exit slit at a constant angle of deviation is varied by counter-rotation of the two prisms to bring the desired wavelength into coincidence with the exit slit.

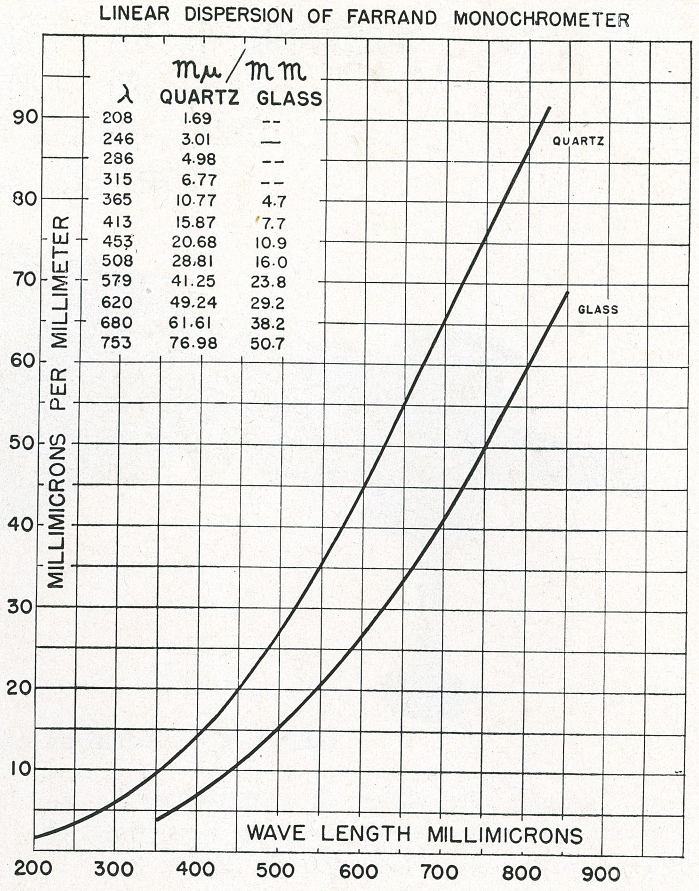
The band width transmitted at a given setting of the wavelength dial is controlled by the entrance and exit slit widths.

The prism mounting permits operation of the system at practically constant aperture throughout the desired spectral range, and this is of extreme importance where a high speed optical system is employed.

DISPERSION

The dispersion of the system is indicated in Figure 2. The spectral curves are expressed in millimicrons per millimeter slit width for both the quartz-lithium fluoride and glass optical systems.

The speed of the Monochromator employing the quartz optical system with f.4 objectives of 300 mm. focal length provides radiation of 1 mμ. band width from 400 mμ. down to 200 mμ. At these band widths the spectral purity is greater than 90%. It must be emphasized here that with band widths this large, the usual consideration of spectral purity for slit widths approaching the "normal slit width" of "Schuster" does not apply. The better criterion is to express the fraction of the total radiation issuing from the exit slit of the Monochromator, which lies within the wavelength range calculated from the dispersion of the prisms and foci of the objectives on geometrical optical grounds, rather than have recourse to the discussion of spectral purity based on physical optics limitations.



mμ/mm

λ	QUARTZ	GLASS
208	1.69	--
246	3.01	—
286	4.98	--
315	6.77	--
365	10.77	4.7
413	15.87	7.7
453	20.68	10.9
508	28.81	16.0
579	41.25	23.8
620	49.24	29.2
680	61.61	38.2
753	76.98	50.7

Fig. 2

SCATTERED RADIATION

The scattered radiation has been determined in the ultra-violet region by measuring the total ultra-violet signal with a thermocouple detector with and without a filter in the beam. The filter is so chosen that its transmission for the ultra-violet is zero and its transmission for the visible spectrum is as great as possible. In taking instrument measurements, it has been found that the total radiation including near ultra-violet, visible, and infra-red from an H 4 quartz mercury arc was less than 0.2% of the output from the 313 mμ. line of mercury when the equivalent slit width of the instrument was 5 mμ.

The performance characteristics indicated in the section under "General Specifications" have all been determined by direct measurement in our laboratories, employing the units both as single and double Monochromators.

GENERAL SPECIFICATIONS

PRISMS

Two 30° quartz prisms are employed in a Thollon type mounting (Fig. 3). The prisms are mounted in individual cells which in turn are mounted and located on the prism drive tables by means of dowel pins. Prisms are rotated by a drive shaft which has been designed to avoid backlash and to operate smoothly.

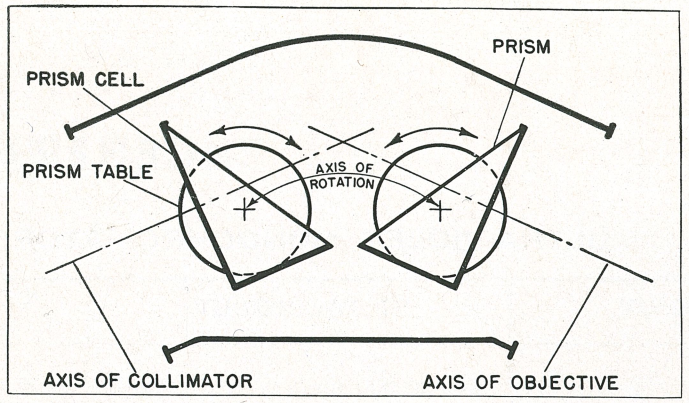


Fig. 3

The wavelength is set by means of two knobs. One is a high speed knob, the other serves as a vernier control with a gear reduction of 5 to 1. Use of the vernier dial makes possible reproducible wavelength settings to within 0.2 millimicrons in the range of 200 to 365 mμ.

An auxiliary plate is available on which prisms can be mounted as a single 60° prism in a fixed position for spectrographic purposes. This leads to an increase in dispersion over that available with the Thollon mounting.

OBJECTIVES

The objectives used for the ultra-violet are quartz-lithium fluoride achromats. The standard objectives are 300 mm. focal length and 75 mm. free aperture. The objectives used to obtain greater linear dispersion and for spectrographic applications are 1000 mm. focal length and 75 mm. free aperture.

The objectives are mounted in cells which are interchangeable in the instrument. The individual objectives may be focussed through a range of 10 mm. and may be set to within .05 mm. by means of the focussing scales, which may be viewed through windows covered by protective shields.

The objectives are interchangeable, making it possible to use either the 300 or 1000 mm. focal length quartz-lithlum fluoride or glass objectives. In cases where work is confined to the visible region 400 to 800 mμ. higher resolution may be obtained by replacing the quartz prisms with glass prisms. Glass optics are available as a separate item.

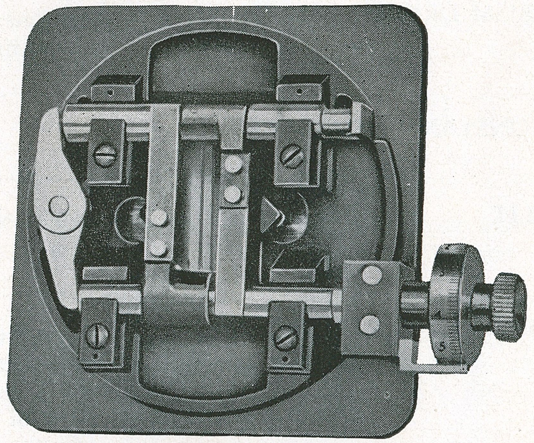
The use of the quartz-lithium fluoride achromats provides a focus constant to within a 0.5 mm. over the range from 250 to 400 mμ. This feature is of extreme advantage in the normal applications of the instrument for ultra-violet spectrophotometric measurements.

Provision is made on the objective cells for introduction of a diaphragm for reduction of the aperture of the Monochromator when desireable.

SLIT

The slit mechanism is of bilateral type, designed to insure parallel motion of the slit jaws and to maintain accuracy. They are constructed of non-magnetic stainless steel, are sharp, and straight edged. The jaws are easily adjusted to set parallel with prism faces. A simple arrangement is provided to facilitate setting of the slit micrometer drum to zero position.

The slit index line is spiralled around the micrometer drum for exact aligning with the index line and the calibration marks on the linear scale. This insures quick and accurate setting of the slit width. The slit unit is removable so that other type slit jaws can be easily substituted.



SLIT MECHANISM

The slit illuminator is a quartz lens condensing system in a tubular housing which is easily mounted on the entrance slit assembly for use when narrow illuminating sources are employed.

SLIT ILLUMINATOR

GENERAL SPECIFICATIONS

	ULTRA-VIOLET MONOCHROMATORS			VISUAL REGION MONOCHROMATORS		
	MODEL 300 UV	MODEL 1000 UV	DOUBLE MONOCHROMATOR MODEL 300 DUV.	MODEL 300 VIS	MODEL 1000 VIS	DOUBLE MONOCHROMATOR MODEL 300 DVIS
RANGE	200 to 800 mμ	200 to 800 mμ	200 to 800 mμ	400 to 950 mμ	400 to 950 mμ	400 to 950 mμ
RESOLUTION	0.2 mμ at 250 mμ	0.06 mμ at 250 mμ	0.2 mμ at 250 mμ for zero dispersion. 0.1 mμ at 250 mμ for double dispersion.	0.15 mμ at 404.7 mμ	0.05 mμ at 404.7 mμ	0.15 mμ at 404.7 mμ for zero dispersion. 0.075 mμ at 404.7 mμ for double dispersion.
OPTICS	Quartz-Lithium fluoride	Quartz-Lithium fluoride	Quartz-Lithium fluoride	Glass	Glass	Glass
FOCAL LENGTH	300 mm.	1000 mm.	300 mm.	300 mm.	1000 mm.	300 mm.
FREE APERTURE	75 mm.	75 mm.	75 mm.	75 mm.	75 mm.	75 mm.
PRISMS	2-30° Thollon type	2-30° Thollon type	4-30° Thollon type	2-30° Thollon type	2-30° Thollon type	4-30° Thollon type
PRISM DRIVE	Precision screw and lever type with adjusting wavelength scale	Precision screw and lever type with adjusting wavelength scale	Precision screw and lever type with adjusting wavelength scale	Precision screw and lever type with adjusting wavelength scale	Precision screw and lever type with adjusting wavelength scale	Precision screw and lever type with adjusting wavelength scale
CONSTANT DEVIATION	46.5°	46.5°	0 or 93°	46.5°	46.5°	0 or 93°
SLIT	Height 30 mm; maximum width 10 mm. adjustable to .005 mm	Height 30 mm; maximum width 10 mm. adjustable to .005 mm	Height 30 mm; maximum width 10 mm. adjustable to .005 mm	Height 30 mm; maximum width 10 mm. adjustable to .005 mm	Height 30 mm; maximum width 10 mm. adjustable to .005 mm	Height 30 mm; maximum width 10 mm. adjustable to .005 mm
WAVELENGTH SCALE	69 cm from 200 to 800 mμ ruled with 1 mμ spacing from 200 to 500 mμ and from 500 to 800 in steps of 5 mμ; provided with adjustment for wavelength calibration of dial	69 cm from 200 to 800 mμ ruled with 1 mμ spacing from 200 to 500 mμ and from 500 to 800 in steps of 5 mμ; provided with adjustment for wavelength calibration of dial	69 cm from 200 to 800 mμ ruled with 1 mμ spacing from 200 to 500 mμ and from 500 to 800 in steps of 5 mμ; provided with adjustment for wavelength calibration of dial	83 cm from 400 to 950 mμ in steps of 1 mμ provided with adjustment for wave length calibration of dial	83 cm from 400 to 950 mμ in steps of 1 mμ provided with adjustment for wave length calibration of dial	83 cm from 400 to 950 mμ in steps of 1 mμ provided with adjustment for wave length calibration of dial
SCATTERED LIGHT	From high pressure mercury arc less than 0.2% at 253.6 mμ	From high pressure mercury arc less than 0.2% at 253.6 mμ	From high pressure mercury arc less than 0.04% at 253.6 mμ	From high pressure mercury arc less than 0.2% at 404.7 mμ	From high pressure mercury arc less than 0.2% at 404.7 mμ	From high pressure mercury arc less than 0.04% at 404.7 mμ
SPECTRAL PURITY	Greater than 90%	Greater than 90%	Data furnished with each intrument	Greater than 95%	Greater than 95%	Data furnished with each instrument
TRANSMISSION	Greater than 40% at 253.6 mμ. and above	Greater than 40% at 253.6 mμ. and above	16% at 253.6 mμ and above	Greater than 75%	Greater than 75%	Greater than 55%

MECHANICAL FEATURES

The mechanical features of the instrument have been designed to assure performance stability regardless of temperature changes. Units and components are easily handled and manipulated. The flexibility of the instrument makes it adaptable for use as a wavelength spectrometer or as a spectrograph. Operation is simple and convenient.

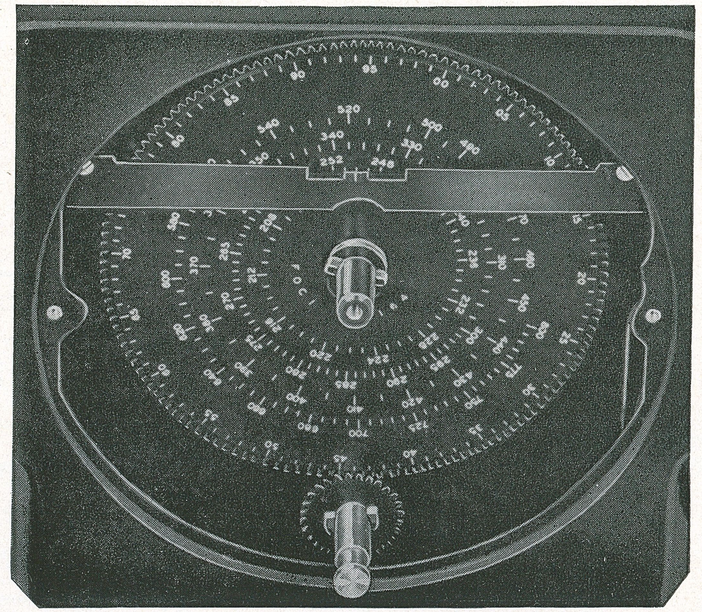
Couplings can be installed on either or both sides of the calibrator unit. Drive shafts which are provided within the calibrator unit of the instrument may be connected to these couplings or directly to the operating end for use with remote, manual, or automatic control of the wavelength scale and can also be coupled to separate recording units, or used to connect two Monochromators together with their wavelength scales driven in synchronism for use as a double Monochromator.

The slit, the SLIT ILLUMINATOR, and other units are readily removable for cleaning. A simple adjustment for zeroing the slit width scale is provided. The bilateral slit is constructed to insure parallel motion of the slit jaws throughout the range 0 to 1 centimeter slit width. Eccentric adjustments of the slit jaws make it possible to align the slit with prism faces.

SCALES AND CALIBRATION

Two scales are provided on the dial, one reading directly in millimicrons, and the other in wave numbers. The wavelength scales for the ultra-violet Monochromator are ruled in 1 mμ. spacing from 200 to 500 mμ. and in 5 mμ. spacing from 500 to 800 mμ. The wavelength scales for the visual region monochromators are ruled in steps of 1 mμ. The design of the prism drive has been chosen to provide an approximately linear relation between wave numbers and angular rotation of the dial.

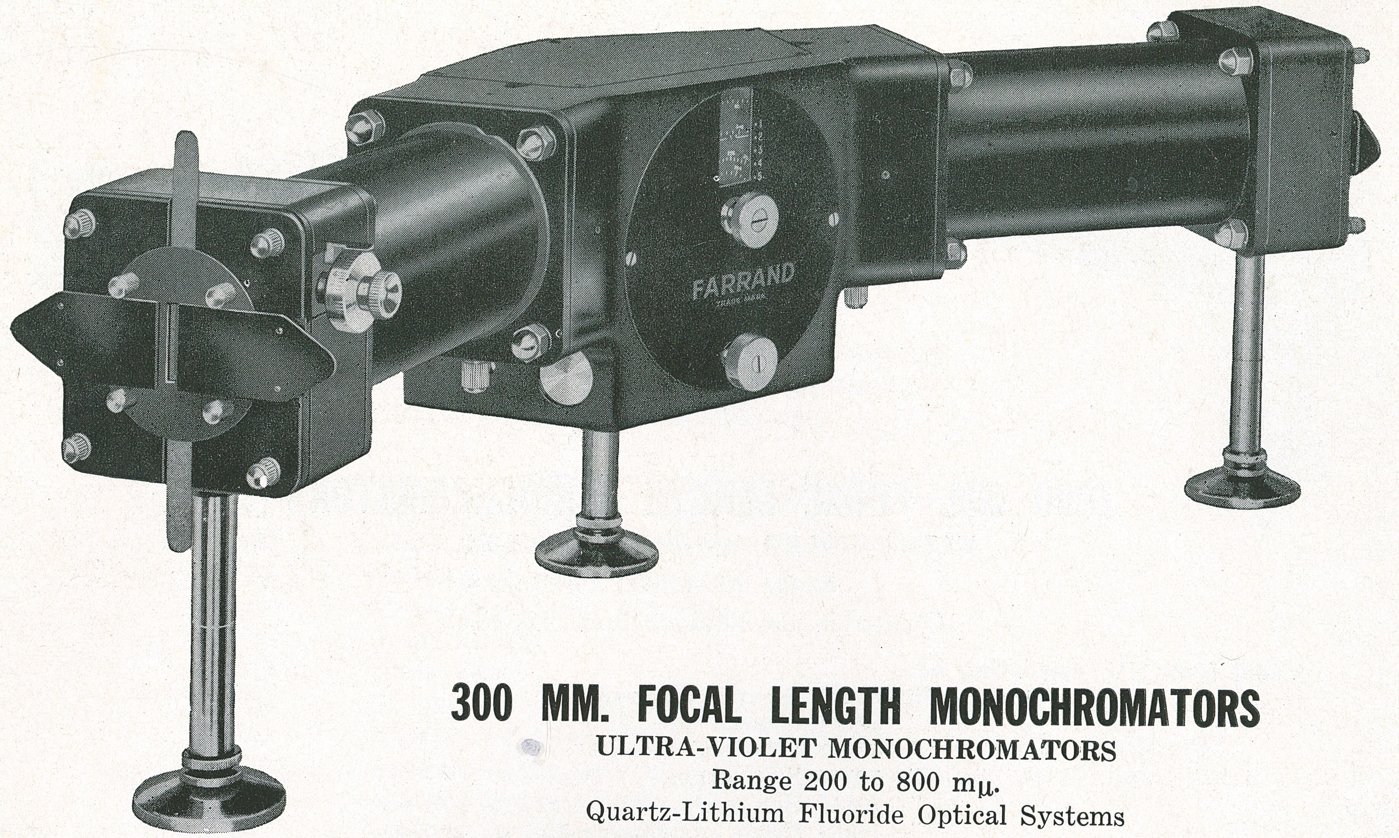
The total length of the scale ruled directly in millimicrons is 69 centimeters. The fiducial mark which is used on the wavelength scale is engraved on a horizontal bar and is driven in synchronism with the spiral wavelength scale. This insures alignment of the fiducial mark with the bottom of the rulings on the wavelength scale.



Interchangeable scales are available for use with glass or quartz prisms. The eccentric adjustments of the prisms on their tables and adjustments of the wavelength dial on its shaft, provide a ready means for setting the calibration of the wavelength dial of the Monochromator.

Three Farrand ultra-violet Monochromators with quartz-lithium fluoride optics are available. Model No. 300 UV is supplied with 300 mm. focal length objectives f:4, Model No. 1000 UV with 1000 mm. focal length objectives f:13.3, and Model 300 DUV Double Monochromator with 300 mm. focal length objectives.

Farrand Monochromators are also available with glass optical systems for use in the visible region of the spectrum. Model 300 VIS is suppled with 300 mm. focal length objectives (f:4), Model 1000 VIS with 1000 mm. focal length objectives (f:13.3) and Model 300 DVIS Double Monochromator with 300 mm. focal length objectives.



300 MM. FOCAL LENGTH MONOCHROMATORS

ULTRA-VIOLET MONOCHROMATORS

Range 200 to 800 mμ.
Quartz-Lithium Fluoride Optical Systems

Model 300 UV. consisting of:

1	each—No.	85111	Spectrum calibrator.
2	” ”	80174	Bilateral slits.
2	” ”	80146	300 mm. telescope tubes.
3	” ”	72715	Foot stands.
2	” ”	70856	Heat masks.
2	” ”	70853	Height adjusting masks.
1	” ”	80153	300 mm. focus objective — Right
1	” ”	81046	300 mm. focus objective — Left
1	” ”	71083	Quartz prism — Right
1	” ”	71082	Quartz prism — Left

Code word MONOC.........................

Model 300 DUV. **DOUBLE MONOCHROMATOR**

NOTE:— Instrument assemblies and accessories desired in a particular laboratory depend on the scope and nature of research or analytical work anticipated, therefore a specific Double Monochromator cannot be cataloged. Laboratories are requested to communicate with us regarding Double Monochromator assemblies.

VISUAL MONOCHROMATORS

Range 400 to 950 mμ
Glass Optical Systems

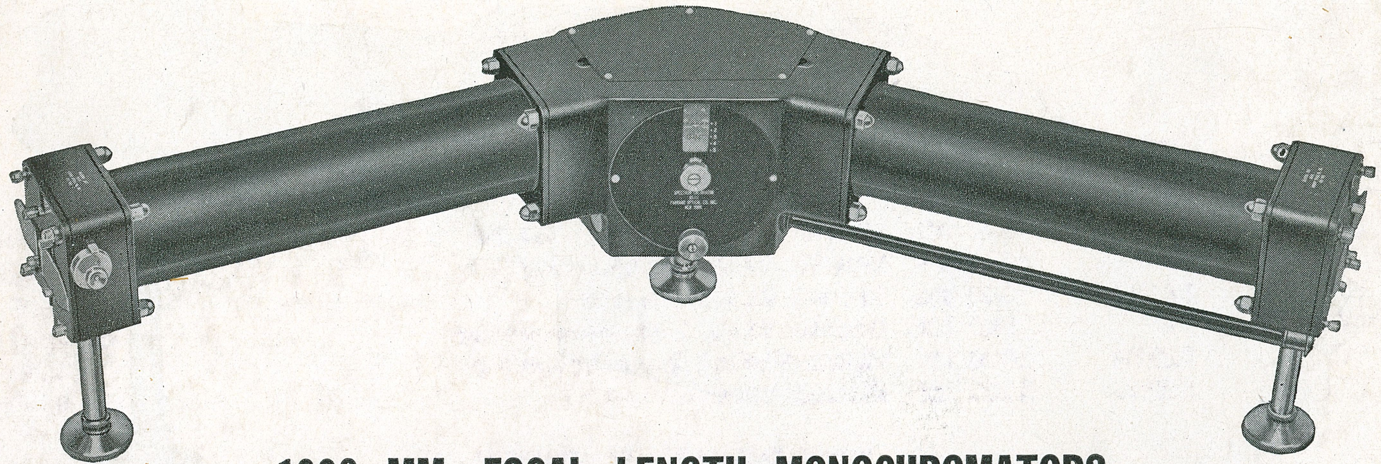
Model 300 VIS. consisting of:

1	each—No.	85111	Spectrum calibrator.
2	” ”	80174	Bilateral slits.
2	” ”	80146	300 mm. telescope tubes.
3	” ”	72715	Foot stands.
2	” ”	70856	Heat masks.
2	” ”	70853	Height adjusting masks.
2	” ”	80769	300 mm. focus objectives.
1	” ”	81394	Prism — Right
1	” ”	81393	Prism — Left

Code word MATRO......................

Model 300 DVIS. **DOUBLE MONOCHROMATOR**

(See NOTE under Model 300 DUV. above)



1000 MM. FOCAL LENGTH MONOCHROMATORS

ULTRA-VIOLET MONOCHROMATOR

Range 200 to 800 mμ.
Quartz-Lithium Fluoride Optical System

Model 1000 UV. consisting of:

1	each—No.	85111	Spectrum calibrator.
2	" "	80174	Bilateral slits.
2	" "	80145	1000 mm. telescope tubes.
3	" "	72715	Foot stands.
2	" "	70856	Heat masks.
2	" "	70853	Height adjusting masks.
1	" "	80152	1000 mm. focus objective — Right
1	" "	81047	1000 mm. focus objective assembly _ Left
1	" "	71083	Quartz prism — Right
1	" "	71082	Quartz prism — Left
1	" "	71080	Drive Rod.
1	" "	72717	Extension drive.

Code word CHROM........................

VISUAL MONOCHROMATOR

Range 400 to 950 Mμ
Glass Optical System

Model No. 1000 VIS. consisting of:

1	each—No.	85111	Spectrum calibrator.
2	" "	80174	Bilateral slits.
2	" "	80145	1000 mm. telescope tubes.
3	" "	72715	Foot stands.
2	" "	70856	Heat masks.
2	" "	70853	Height adjusting masks.
2	" "	80770	1000 mm. focus objectives.
1	" "	81394	Prism — Right
1	" "	81393	Prism — Left
1	" "	71080	Drive Rod.
1	" "	72717	Extension drive.

Code word ROMAC..........................

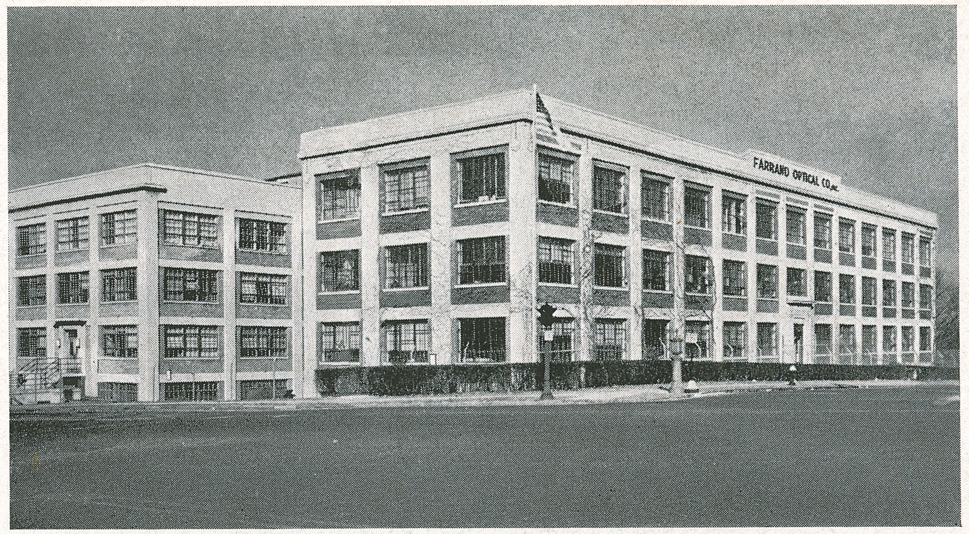
SLIT ILLUMINATORS

For Ultra-Violet Monochromators

Catalog No. 80156 — Slit Illuminator consisting of quartz lens condensing system; suggested for use where narrow illuminating sources are employed —
Code word COMAT..

For Visual Monochromators

Catalog No. 80771 — Same as 80156 but with glass lens condensing system
Code word CATOR..



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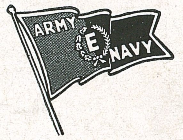

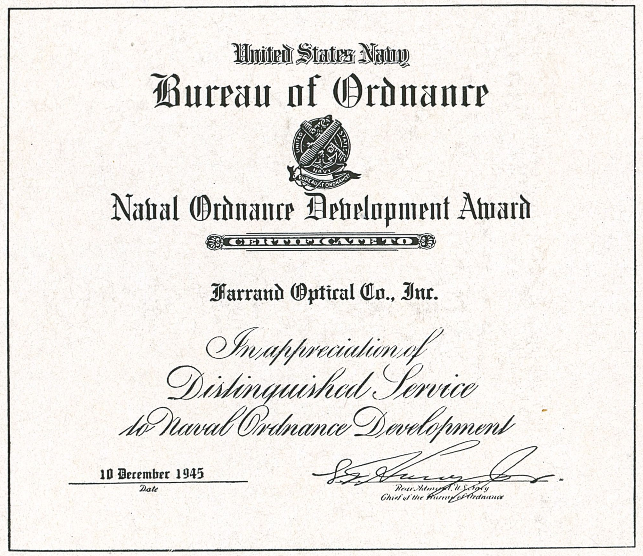

United States Navy

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10 December 1945
Date

Rear Admiral, U.S. Navy
Chief of the Bureau of Ordnance

FARRAND OPTICAL CO., INC.

Engineers, Designers and Manufacturers

PRECISION OPTICS, ELECTRONIC AND SCIENTIFIC INSTRUMENTS

BRONX BLVD. & E. 238TH ST. NEW YORK 66, N. Y.

BULLETIN - 801 - MAR. 1947

PRINTED
IN
U. S. A.

FARRAND OPTICAL CO., INC.
New York

Revised
June 30, 1949

PRICE LIST FOR BULLETIN 801

MONOCHROMATORS

Catalog Number	Code Word	Description	Price Each
300 UV	MONOC	300 MM. Ultra-Violet Monochromator	$4,950.00
* 300 DUV	-	300 MM. Double UV Monochromator	On Application
300 VIS	MATRO	300 MM. Visual Monochromator	3,500.00
* 300 DVIS	-	300 MM. Double Visual Monochromator	On Application
1000 UV	CHROM	1000 MM. Ultra-Violet Monochromator	4,850.00
1000 VIS	ROMAC	1000 MM. Visual Monochromator	3,600.00

MONOCHROMATOR ACCESSORIES

Catalog Number	Code Word	Description	Price Each
80156	COMAT	Slit Illuminator "Quartz"	240.00
80771	CATOR	Slit Illuminator "Glass"	140.00
80174	BILAT	Bilateral Slit Assembly	315.00
80146	TELUB	Telescope Tube 300 MM.	70.00
72715	FOSTA	Foot Stand	10.00
70856	HEMAS	Heat Mask	10.00
70853	TOWER	Height Adjusting Mask	4.00
80153	OBSHA	Quartz-Lithium Fluoride Objectives, 300 MM. Focus, RH	675.00
81046	OBLET	Quartz-Lithium Fluoride Objectives, 300 MM. Focus, LH	675.00
71083	PRIMS	Quartz Prisms, RH	500.00
71082	LEPRI	Quartz Prisms, LH	500.00
70851	COLET	1000 MM. Collector Cell (Quartz)	300.00
70850	SOCOL	300 MM. Collector Cell (Quartz)	300.00
72717	DRIVE	Extension Drive	35.00
71080	RODOT	1000 MM. Drive Rod	16.00
80152	OBRIT	Quartz-Lithium Fluoride Objectives, 1000 MM. Focus, RH	595.00
81047	OBLOW	Quartz-Lithium Fluoride Objectives, 1000 MM. Focus, LH	595.00
80145	TELUS	Telescope Tube 1000 MM.	85.00
81068	CAMPE	Camera Plate	30.00
80769	GLOST	Glass Objective 300 MM. Focus	260.00
81394	GLAPO	Glass Prism, RH	250.00
81393	GONAR	Glass Prism, LH	250.00
80770	OGLAN	Glass Objective 1000 MM. Focus	250.00
90776	VISUA	Calibrated Wavelength Dial Visual Range)	
73186	GERVI	Gear Idler Assembly Visual Range)	46.00
80164	ULTRA	Calibrated Wavelength Dial - Ultra-Violet Range)	
73177	ULGE	Gear Idler Assembly Ultra-Violet Range)	46.00
73175	SPLAT	Spacer)	

* Instrument assemblies and accessories desired in a particular laboratory depend on the scope and nature of research or analytical work anticipated, therefore a specific Double Monochromator cannot be cataloged. For information on Double Monochromators, please communicate with us.

Prices f.o.b. New York; terms net 30 days in U.S.A.; subject to change without notice. Federal, State, or other taxes not included.